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SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

The facts and the figures that prove soil conservation measures make yields and make money—A Minnesota experiment in maintenance of State highways, so important to war use—A spunky Iowan at work on his Victory farm—Meet them all in this timely issue

UNITED STATES DEPARTMENT OF AGRICULTURE – WASHINGTON

Contents

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CONSERVATION PAYS OFF IN THE PLAINS COUNTRY

By H. H. FINNELL [1]

An occasional critic writes us, tells us, or publicly proclaims, in all sincerity, that in his opinion the per acre cost of soil conservation achieved through the program of the Soil Conservation Service is too high. It seems to me that such criticism is in some degree refuted by the fact that farmers everywhere—the great majority of them, both those who have adopted the program on their own land and those who have seen the work in open fields in every step of its progress, as well as the results—want more and more of it on their farms. A further indication of the practicality of soil conservation practices—not forgetting cost—is the fact that within less than 5 years something over 2 million farmers, on their own initiative and of their own volition, have organized under State laws 736 soil conservation districts, comprising approximately 432 million acres of land in 41 States, and all of them have asked the Service's help in setting up and carrying through their conservation farming programs.

Farmers, I think, do not go in for matters of this nature until they have completely convinced themselves that what they are asking for—and are getting in most of the States, through huge majorities in referenda of the democratic type—is sound from the practical, scientific, economic, and social angles.

Still further evidence of the basic soundness of the program is found in the action of 139 of the districts: these districts, after actual experience with the work of the program, and at the request of neighboring farmers have voted or legally arranged for enlargement of the size of their areas. Some 42 million acres were added to districts in this manner in 25 States in approximately 4 years. One district in Nebraska has been extended through 25 separate petitions of neighboring farmers and has increased in size from 62,185 acres to 287,112 acres.

Perhaps the mere word "conservation"—a good, solid word—has kept many friends of the Service from faltering in their faith in the program. Others have undertaken to justify the expense by emphasizing the experimental character of the work or the excessive effort required to overcome the inertia so commonly encountered in getting a thoroughly new program under way. Other causes of what some have felt were excessive expenditures have involved the diffi-

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culties of establishing and maintaining working relations with other agencies, and with the necessity of training technicians to pool their respective skills for effective application of a program that calls for coordination of various types of practical and scientific knowledge into a single working tool.

Then, too, there was in the earlier days of the Service the necessity for making use of large amounts of relief labor without always having time for adequate planning.

But these in a sense are things of the past. The Soil Conservation Service now has arrived at that stage of progress where it is definitely known that the costs to the Federal Government for soil conservation work in the Southern Great Plains region—the "Dust Bowl," so-called—are more than offset by the accumulated benefits to the land and land operators. Nor has this any reference to intangibles or benefits hoped for in the future, but only to work accomplished and benefits duly received.

The program, it must be pointed out, has been helped directly or indirectly by other agencies, such as the Extension Service and the AAA. Without such help the results might not have been nearly so good.

Even the mistakes that have been made have served for the most part as guides to subsequent operation, to such an extent that many of them probably have done more good than harm. Thus we can now burn the mortgage and begin planning for the expansion that is justified by profitable results already produced.

Table 1 presents the progressive results of 8 years of soil and water conservation work carried out in the Southern Plains: the dollar returns from dollar investments, based on actual accounts and records and on careful evaluation of results, except for 1942 which is estimated on the basis of work so far accomplished.

TABLE 1.—*Accumulated expenditures and production of plans, completions, and benefits in the Southern Great Plains Region (estimated for 1942)*

Year	Regular appropriations	Detailed farm plans	Combined treatment completed	Benefits returned [1]
	Thousands of dollars	*Thousands of acres*	*Thousands of acres*	*Thousands of dollars*
1935	60	29	17	13
1936	1,439	232	137	117
1937	3,041	896	528	518
1938	4,398	1,482	874	1,181
1939	6,234	4,313	2,544	3,112
1940	7,976	6,508	3,840	6,026
1941	9,289	10,234	5,821	10,444
1942	10,890	13,134	7,749	16,326

[1] Increased production resulting from conservation of rainfall, maintenance of normal production, and maintenance of capital value—the soil.

In substance this record shows that while the first year's expenditures under the Soil Conservation Service program for the Southern Plains area exceeded the benefits by 4.6 times, the accumulated costs were very much more than balanced by the seventh year and promise to be exceeded by nearly 50 percent in the eighth year.

A private industry operating on such a rate of returns on its investment would be criticized for profiteering. It is idle to speculate as to how long it will be until the taxes alone, from the rapidly mounting accumulation of benefits, will be sufficient to keep the Soil Conservation Service in operation and yield surplus revenues which may be applied to the retirement of the public debt. Nevertheless, the possibilities of expansion of this margin of profit might conceivably go on until all soil and water resources have been developed to their highest productive efficiency commensurate with permanent maintenance. In the Southern Great Plains Region, combined treatment of land could be completed 10 times as fast as it is now being done and still leave 5 or 6 years of detailed planning work yet to be done.

The potential net annual return from soil and water conservation work in the whole of the Southern Great Plains Region is computed at 97.9 million dollars. This means that if and when a detailed conservation program has been completed on all the land in the region, the current net profits on con-

TABLE 2.—*Analysis of farm planning and treatment in Southern Great Plains Region, including estimated costs and benefits. (Calculated from data reported from seven offices for the calendar year 1941* [1])

	Denver	Pueblo	Salina	Dodge City	Clovis	Perryton	Lubbock	Total for region
Farm plans	288	288	1,084	246	281	140	323	2,650
Acres planned	366,427	817,249	250,570	110,302	521,780	291,082	296,348	2,653,758
Acres—combined treatment	281,854	344,734	138,712	145,233	391,551	366,748	331,239	2,000,071
Technical hours	84,733	54,659	212,347	72,814	63,133	64,191	114,915	666,792
Minutes per acre completed	18.0	9.5	91.8	30.1	9.7	10.5	20.8	20.0
Planning and treatment cost per acre	$0.469	$0.194	$1.889	$0.997	$0.256	$0.331	$0.615	$0.52
Total cost for planning and treatment completed	$132,190	$66,878	$262,027	$144,797	$100,237	$121,394	$203,712	$1,031,235
Percent of range land	69.0	85.7	48.4	29.4	79.1	76.0	61.0	69.5
Percent of crop land	29.8	13.1	48.0	69.6	20.3	23.0	38.0	29.3
Percent of other land	1.2	1.2	3.6	1.0	0.6	1.0	1.0	1.0
Average annual benefits per acre—range land	$0.094	$0.05	$0.24	$0.20	$0.14	$0.14	$0.14	$0.12
Average annual benefits per acre—crop land	$1.88	$1.10	$3.80	$2.37	$1.88	$2.65	$2.65	$2.40
Estimated total annual benefits for planning and treatment completed	$176,186	$64,448	$269,124	$248,104	$192,792	$262,555	$361,846	$1,575,055
Ratio of benefits to cost	1.33:1	.96:1	1.03:1	1.71:1	1.92:1	2.16:1	1.78:1	1.53:1

[1] LU data have been omitted from this analysis.

servation work will approximate 97.9 million dollars a year. The actual money in the pockets of farmers and ranchers who have completed conservation work in the region is estimated at 5.9 million dollars during the calendar year 1942.

This means that the job is about 6 percent completed. If a 6 percent completion of the total job to be done in the Southern Great Plains Region is capable, as it has proved to be, of returning sufficient benefits at the end of 7 years to pay off the Federal cost, then certainly a greater investment and a more rapid rate of accomplishment can be justified both from the economic and public interest point of view.

Summing up the work of the region, including 1942, the regular appropriations spent by the Federal Government during the 8 years of Soil Conservation Service activity amount to approximately $10,890,000. The total accumulated net profits to landowners and operators, resulting from the Service program during the same period, are estimated at approximately $16,326 000, exceeding the Federal cost by 5.4 million.

To our critics we can now say: Soil conservation is not an uncertain investment; it is not even a financial risk. Soil conservation is an investment in the future only in part; it is an investment in the future which more than pays its way as it goes. Often benefits exceed the cost the first year, although this is more frequently the result in areas of higher rainfall.

Many well-meant suggestions have been voiced along the line that savings should be made by disregarding certain problems or by arbitrarily eliminating certain phases of work. Individual cases show that incompleteness and lack of thoroughness are the most common causes of failure of conservation plans.

Results obtained by adhering to a complete program—treating whole farms with all available measures economically and properly coordinated to meet the needs and adaptabilities of all the lands of each farm—have proved that what we needed was not to know how to make a bad investment worse by lowering the quality of work done, but how to make a good investment better by perfecting yet higher standards for the quality of work done. The Soil Conservation Service program does not need to be streamlined. If anything needs streamlining, it is our procedures. What we are doing is all right; how we go about it might be improved.

I shall have to admit that I was very much upset when I first discovered that in one area of the Southern Plains Region the technical time expended per acre of combined treatment completed amounted to only 9.5 minutes, while in another area of the same region 91.8 minutes were spent on an area of the same size. Had there been a glaring discrepancy in the efficiency of personnel? Or was the difference due to the quality of the work done? Analysis of the question, however, has shown that when all the elements are evaluated the discrepancy is more apparent than real.

The study substantiates the contention that regardless of land values, regardless of the seriousness of the erosion problem, regardless of the differences in efficiency which normally exist between employees, and regardless of the intensity of land use, a high quality, completely detailed, adequately coordinated and permanent program of soil and water conservation is *worth what it costs and more.*

The 1941 work year for the Southern Great Plains Region (Region 6) is summarized by areas in table 2.

(*Continued on page 6*)

SEVEN YEARS OLD, AND A WAR JOB TO DO

Seven years old, goin' on eight!

Like many another sturdy American lad, *Soil Conservation* is pretty much stirred up about the war, and determined to lend a hand toward its winning.

Having now attained the long-pants maturity of Volume VIII, the magazine proudly elects to lop off its cuffs. There will, in consequence, be somewhat fewer pages per issue in the future. Each page will carry a bit bigger load of type, margin waste being eliminated. Numbers of other changes will be effected, most of them less noticeable. It all adds up to appreciable savings in paper and other items. The physical economies are a reflection of the magazine's intent to continue alert, timely, vital.

Readers of *Soil Conservation* may as well make up their minds to see a lot of our American flag henceforth, for it is due to grace the front of the magazine for many months to come. To my mind, Old Glory constitutes the most comprehensive, inspiring and worthy emblem available to our working democracy—whether it flies from the prow of a destroyer or from the ramparts of an aroused agriculture. (To achieve his dramatic rendition of an admittedly difficult subject, Artist Simmons obtained a flag and studied its action in a breeze.)

Uhland's article in May, Enlow's and Lowdermilk's articles in June, Finnell's and Loyd's noteworthy contributions to this issue are fair foretastes of the editorial lines which *Soil Conservation* intends to pursue for the duration. Truly, "the flag is on the plow"—and it is likewise on *Soil Conservation*.

—WELLINGTON BRINK, *Editor*.

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When the amount of range land compared to cultivated land and the actual increases in production accomplished by conservation work are taken into consideration, it is revealed that the results produced are actually in keeping with the expenditure of technical hours per acre. Annual benefits to range land vary between 5 and 24 cents per acre, while those of cultivated lands vary between $1.10 and $3.80 per acre. In general, these variations in the value of a program are in line with the technical hours spent by the Service in getting a program completed.

Nearly 10 times as much time was spent by technicians for each acre planned in eastern Kansas as was spent in eastern New Mexico. The cost of planning and treatment per acre, however, was only about 7 times as much. The first year's benefits exceed the cost to the government both in eastern Kansas and in eastern New Mexico. Most differences in ratios of cost to benefits can be explained largely by the variation in natural conditions which determine the potential limits of improvement in land and water utilization.

Estimates of annual benefits in all cases are based on research and evaluation studies rather than on farmer opinion, although farmer opinion strongly substantiates the conclusions reached. The results, in terms of immediate income, show that both the government and the farmer are justified in spending nearly 10 times as much per acre in eastern Kansas as in south eastern Colorado. This is according to the needs and adaptabilities of the land. It is not because it costs more to complete the job, but because it is worth more. All costs either in high-cost or low-cost areas are usually paid off in immediate or early returns. In other words, *conservation is worth what it costs and more*.

We should not boast of the fact that, in spite of amateurishness, inconsistency, waste, and lost motion, the soil conservation program has paid out. But a thing we can be proud of, and the thing which should be utilized to the fullest extent is the fact that the physical and economic effectiveness of the technical program has been proved. In so doing, we have revealed an undeveloped productive potential which is available for increased war production. This fact should urge us forward to gain the mastery more quickly of all our agricultural and land use problems, so that agriculture can be sure of doing its expected part in the war.

Conservation of farm labor in time of war is no less important than conservation of the soil. Farm accidents in the United States claim a substantial part of farm income and more than 4,200 human lives each year. Every farmer should learn how to reduce hazards on his farm.

Watch that fire! Some 3,500 persons are burned to death in fires on farms and in rural communities each year; the loss runs to about $200,000,000. Forest and grass fires take an enormous toll in property damage. Along with safeguarding the soil, throw out added protection against farm fires. These are days when we cannot afford to waste soils, farm property, or manpower.

Total war means utilization of every available resource. The ideal, speaking in terms of agriculture, is to obtain the maximum productive efficiency from every acre, every tree, every machine, every drop of water, every pound of fertilizer, every animal, every farmer and his family. This ideal is coupled with the ideal of protecting the soil resource so that after the war the land will still be productive and fully capable of meeting the continuing needs of a great and prosperous people.

STREAMLINING CUTS WARTIME UPKEEP

By GLENNON LOYD[1]

Concrete slabs throb under their wartime load. Indispensable food rushes to market over rural byways. Rumbling trucks form the inseparable right arm of the Nation's long haul to victory. Joyrides are out of fashion, gasoline rationing prevails in the East, and declining income from gaoline taxes already reflect the shrinkage of nonessential motor traffic.

In these circumstances county, State and Federal road officials are confronted with the difficult problem of keeping the highways in shape for the duration. They are keenly aware that fixed charges normally consume more than one-fourth of all highway income, and that as revenues drop the percentage lopped off by fixed costs rises.

With upkeep now the big problem, highway officials of Minnesota fortunately have a 5.17-mile stretch of "test tube" highway that has produced several ways of making the maintenance dollar stretch farther.

The "test tube" lies between the towns of Pine Island and Zumbrota on Highway 52, a trunk artery between Minneapolis-St. Paul and Rochester. High snow-removal costs and excessive expenditures for right-of-way maintenance were two of the factors influencing the selection of the spot for the demonstration.

The road between Pine Island and Zumbrota, which was paved in 1930, included a variety of curves, intersections, hills, cuts, and fills. By 1938, when the improvement was undertaken, there was a great deal of erosion along the slab. In some spots, soil washed from the bare slopes of cuts had filled ditches and caused frost heaves in the pavement. In other places run-off had damaged embankments and gullied drainageways.

Fertile land, moderately rolling, adjoins the demonstration, and the farmers, who went out of their way to cooperate, are engaged primarily in the production of milk, beef, pork and other victory foods.

The State Highway Department of Minnesota developed plans for the demonstration, with the Soil Conservation Service making recommendations on erosion control measures and the Bureau of Public Roads cooperating. Drainage facilities were redesigned to eliminate erosion on the road shoulders, in cuts, on fills, in roadside ditches and on adjacent farmland. Safety also was given weighted consideration as the blueprints were developed. Here was an opportunity to demonstrate effectively the safety facilities that can be incorporated in highway systems.

A masonry dam straightjackets the unruly waters spouted from a culvert.

When the plans and specifications were completed, the State highway department provided all heavy equipment, some concrete forming, and the necessary skilled labor for grading, tillng and seeding operations. The CCC camps at Zumbrota matched this with quarry equipment, small tools and husky youths to keep them busy.

Additional right-of-way was procured, and the job of streamlining the roadways along the two-lane highway began. Ditches were widened and there was extensive mulching, seeding, and sodding. Some culverts were extended and headwalls were constructed on others that could not be raised to meet new ground levels.

Shoulders on the highway were widened to an 8- to 10-foot minimum and all surface drains were repaired from the old shoulder line to the toe of the slope to conform with the new cross-sections of the road. Also, from a safety standpoint, sight distances at curves and intersections were lengthened, slopes were flattened, ditches were filled in and widened, guard rails were eliminated and dangerous check dams in ditches were covered.

Some of the farmers donated seed for seeding operations. In return, they got improved farm entrances, protection from gully erosion along the right-of-way, and saving in maintaining fences. The

[1] Head, regional current information section, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

Back slopes and side ditches here underwent a transformation—they were reshaped and seeded. Grading permitted the growth of vegetation which licked erosion.

work also provided the farmers a strip of alfalfa hay between the road shoulder and the right-of-way fence. They have been urged to harvest the strip and most of them are doing it.

Prior to the improvement, the steep slopes and embankments were expensive to mow since most of it had to be done by hand. Snow removal likewise was difficult because the sharp cuts invited deep drifts that could be cleared only with heavy plows. Likewise, more than a mile of guard rail formerly scattered along the road on shoulder embankments as a safety measure had complicated mowing and snow removal.

Now the entire stretch of concrete is flanked by grass, nature's best guard against erosion. It presents a pleasant as well as practical picture, with its streamlined cross-section comprised of graceful shallow gutters and rounded backslopes.

This improved road has weathered a most severe test. When a 4½-inch cloudburst struck the area, July 10, 1940, the roadways took the drenching in their stride. It was the heaviest downpour in the area in 50 years, but there was no apparent erosion along the road.

State highway officials report that all repairs and construction work on the State and State aid roads now is being done according to specifications similar to those used on the demonstration, and that county highway officials are beginning to follow the example set by the State. State and Public Roads officials use the demonstration as a show window for the benefit of highway engineers.

Out went a check dam, and in its place a carefully graded gutter to conform to the streamlined cross-section. In the picture above, the man at the left stands at the bottom level of the original ditch. The alfalfa hay in the picture below is quiet testimony of the wonders wrought.

Sodding proved effective where there was overdrainage of bank slopes, and where ditches carried large quantities of water on steep grades—and contracts by the State highway department for this preventive measure show how popular it has become. In 1936 only 6,395 square yards of sod was laid on roadways in the State, but in 1941 the total reached 1,385,000 square yards. Bids on sodding for Minnesota highways averaged about 15 cents per square

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IOWA'S WIRKLER AND HIS VICTORY FARM

By GLENNON LOYD[1]

Helmuth Arno Wirkler, called "Butch," talks "soil conserving" everywhere he goes—and he gets around in northeastern Iowa.

Butch is a solid chunk of a man with massive shoulders. He wears no ordinary man's collar—his neck calls for size 20. Fifty-five years old, he does a day's work along with his 27-year-old son, Merle, now the junior partner on the place. In keeping with this, Butch has a ruddy complexion, an energetic mind and a refreshing sense of humor.

I went to the farm to find out how Butch Wirkler was answering his country's call for more eggs, pork, and milk to meet wartime needs, and why he had acquired a reputation as a crusading soil conservationist. This Iowa farmer, who likes to talk "soil conserving" even more than to go fishing, was waiting at the farm for me in spite of the fact that, as he said, he had been tempted to slip down to the dam to catch a mess of catfish for supper.

Last winter Butch spoke on soil conservation at more than 20 meetings. Seven of them were in connection with the expansion of the Clayton County Soil Conservation District, of which he is a commissioner. He also told his appealing story before civic clubs, luncheon groups, farmers' meetings in other counties and over radio stations.

Butch isn't the "do as I say, not as I do" type. He practices what he preaches and, to use his own words, "I haven't a row on my place that runs up and down hill."

He lives on a 240-acre farm northeast of Elkader, Iowa, in a community where most of the farmers are of German descent and are thrifty and efficient. A glance at the countryside shows you that the "seeds" of soil conservation sown by Butch in the minds of his neighbors and friends have had a high percentage of germination. Approximately 200 farmers in the county now have complete farm plans, and an additional 400 have some contouring and other soil-saving practices.

Ten years ago, like most other farmers in the Nation, Butch cultivated his slopes up and down hill and gave little attention to erosion. The only thing that concerned him was that three gullies were working back into his fields. Seven years ago he visited a CCC camp in the county to see if he could get some help in plugging up the gullies.

"Well, the boys came over," he recalls, "and we fenced off the ravines and planted them to trees. I had no idea at that time, though, that I'd ever be using any soil conservin' practices. Then one day a boss from the camp came back. Out of courtesy, I went out with him to look the place over and he began to talk strippin'. It was so raw and windy that almost before I knew it I had agreed to let the boys strip the back forty. It was back out of sight and I didn't think there would be so much talk about it among the neighbors if I could hide it.

"I felt foolish, but I thought about it so much that I just had to tell somebody to release the pressure. So the next day when I was riding with two of my neighbors to a sale, I started several times to tell them what I had done. Finally, when we were almost there, I told them, and as soon as we arrived I lost myself in the crowd to get away from their ribbing."

But Butch was not ribbed for long about the strip-cropped back forty. "When we were going through the corn the second time that year, we had a big 3-inch rain that sold me on soil conservin'," he continued his story. "I went out on the back forty and looked. There was practically no soil washing there. But the waterway draining an adjoining field was filled with silt from the slope planted up and down hill. That switched me over from thinking I was doing the CCC boys a favor. They were doing me a great big one."

Since then he has returned the favor manyfold. His complete farm plan is a productive blend of contour strip cropping, buffer strips, terraces, game refuges, and grassed waterways. These supporting practices are coupled with liming, manuring, fertilizing, and an easy-on-the-land rotation of corn, oats, meadow and meadow. The 210 acres of work land on the Wirkler farm, Butch estimates, now produce about a third more than they did before he took up soil conservation.

"Here at our place we have quit robbing future generations of the benefits of this rich soil," Butch asserts. "Our soil conservin' practices hold the soil and moisture where we want it and the lime and fertilizer right where we put it. We know that contouring makes operations easier and we get the work done with less power. We also have the satisfaction that comes with knowing none of our crops will be washed out and that our topsoil won't be down in a gully the morning after a rain. For those of us who used to pick corn up and down hill, believe me, picking it on the level is a real pleasure."

Our country is clamoring for more eggs, more

[1] Head, regional current information section, Upper Mississippi Region, Soil Conservation Service, Milwaukee, Wis.

pork, and more milk. A year ago Butch had 300 hens. Now he has 400 laying. Last year he raised and fed out 200 pigs to an average of 260 pounds, heavier than usual. This year he saved 240 spring pigs and plans to raise 50 additional fall pigs. A year ago he was milking 24 cows. Now there are 32 milkers in his Guernsey herd and production is at peak. That's really stepping up production on the farm assembly line, isn't it? In addition, this farmer is contributing to the war effort by purchasing war bonds, encouraging his neighbors to do likewise, and selling all the scrap iron from his place. In answer to the appeal for more soybeans, he planted 10 acres of that crop. The beans are on the level land and, needless to say, they are on the contour.

This year, in order to get more feed for his enlarged herd of hogs, he planted 70 acres to corn—130 percent of his AAA acreage allotment for that crop. He felt that he could do this in the emergency because he knew which part of his land was in such shape that he could impose on it without destroying the soil's fertility and productivity.

"I won't get my corn payments," he explains, "but I'll still get my payments for soil conservin'. I am a firm believer in the Triple A and I always have been. I think it is the only thing that held us farmers together, and we're going to need it more than ever after the war ends."

Butch has been on almost every strip-cropped field in his county. The county AAA committee uses him to measure the strip-cropped fields. He maps and measures them when they are laid out. It is much easier to measure the fields then, and it has an additional advantage—the farmer can plant strips with the assurance that he is keeping within his acreage allotments.

On his own farm, because of his rotation, Butch can operate his strips on a two-field system and pasture all the strips in one field each year without putting in temporary fences. He takes proper pride in the fact that in the 22 years he has been on his farm he has seeded only 5 acres of oats without a legume mixture. For both hay and pasture, he uses a mixture of alfalfa and red clover, with a little timothy. His corn yield the last few years has been averaging 100 bushels per acre, 30 percent higher than it was back in the days of up-and-down hill cultivation. He attributes part of the increase to his soil-saving program and part to hybrid seed. His pastures are better, his hay yields higher and his oats yields also are up. Under his rotation system, Wirkler turns under sod for his corn ground, and he never sells any corn or oats as grain. He has spread 375 tons of lime on 115 acres of his cropland in the last 6 years.

"Butch" Wirkler flaunts three lusty "squeals" for freedom.

In addition to the 240-acre farm, Butch has 40 acres in a large timber tract 3 miles from his place. He considers it a "very valuable piece of property." His timber furnishes all his fuel and fence posts, and there is ample saw timber for his needs. He has cut lumber from it to build his two-car garage and for an addition to his residence, a granary that holds 5,000 bushels of corn and 2,500 bushels of oats, and a chicken house accommodating 300 birds.

Butch's neighbors and friends keep him well supplied with tales of their experiences with soil conservation, and he uses them effectively in his talks.

For example his neighbor, Ray Reierson. was a bit skeptical about the benefits of contour planting, but was willing to try it. Reierson planted one field to corn on the contour last year, but another field not as steep or as eroded, he treated the old up-and-down-hill way. The yield from the contoured field averaged 90 bushels last fall, 35 bushels per acre more than the one planted in straight rows.

Butch also tells of another friend of his who vowed "I'd quit farming and sell the place before I'd farm

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THE UNEXPECTED REJUVENATION OF GEORGE CREEK

By G. C. DOBSON AND H. A. EINSTEIN [1]

THE case history of George Creek is the story of a small stream that has passed through a complete cycle of sedimentation within the time of men now living. Beginning as a stream that fulfilled the proper function of draining its watershed without frequent and severe flooding of its bottom lands, it experienced a relatively long period of aggradation that clogged the channel with sediment, raised the water table and turned most of the valuable bottom land along it into worthless swamps, and then entered upon a period of rejuvenation that in a relatively short time degraded the bed sufficiently to enable it again to drain its area effectively. That this rejuvenation was the unpredicted and unexpected result of the construction of a dam and the installation of some sand pumps not only makes the case more interesting but leads to the intriguing question of whether it would be possible to develop an economically feasible soil conservation practice for inducing this process of rejuvenation.

George Creek is a small tributary of the Saluda River in South Carolina. It has a length of about 10 miles and a drainage area of about 30 square miles. It crosses the old Greenville-Easley highway 3½ miles above its confluence with the Saluda River. Within these lower 3½ miles, the stream has a bed width of from 30 to 40 feet and flows through an alluvial flood plain that averages about 300 feet in width.

From talks with many farmers and residents of long standing in the community, owners and operators of sand pumps, and officials and operators of the nearby power plant on the Saluda River, it has been possible to reconstruct the history of George Creek with reasonable accuracy.

Up to the time of the War between the States, the channel capacity of this stream was sufficient to carry all flows but the more exceptional floods without overbank flow. These occasional floods very slowly built up the flood-plain surface with sediment of fine texture, predominantly silt and clay. In the post-war period the readjustment of agricultural management, together with the development of transportation facilities, brought about a great increase in cotton acreage in this area and a marked increase in soil erosion. This accelerated erosion greatly increased the amount of sediment delivered to George Creek. When the coarse sediment or bed load exceeded the transporting capacity of the stream, the sediment began to deposit on the bed and clog the channel. This process of aggradation continued until only 1 to 2 feet of free banks remained. The raised water table that resulted from this process, combined with frequent flooding, transformed the whole valley into a swamp or marsh, usable only in spots as low-grade pasture. Accompanying illustrations show Beaverdam Creek in the South Tiger watershed where these conditions still prevail.

In the years 1905–6 a hydroelectric power dam was built on the Saluda River about 4 miles above its confluence with George Creek. At that time the Saluda River was similarly choked with sediment. It is said that although the dam trapped the whole supply of coarse or bed sediment moving down the river, the channel below the dam did not change noticeably for a number of years. In 1925 a commercial sand pump was installed on George Creek about 1½ miles above its mouth. The quality of the sand proved to be excellent for building purposes, and, therefore, large quantities were sold. Several more pumps of the same type were set up along the stream in the following years. In 1928 the Saluda River had an extremely high flood that resulted in cleaning out the river bed below the dam, lowering it a number of feet. Since that time, the bed of George Creek has been lowered gradually to a position 8 to 12 feet below the banks. The valley bottom has not been flooded for several years and the formerly useless swamps now make first-grade pastures and cornfields.

Within the last 2 or 3 years there has been a noticeable reduction in the supply of sand coming down the creek. The owners of the commercial pumping plants are complaining about it, but the farmers along the creek are well pleased. Two influences could be responsible for this reduction in the supply of sand—the effect of soil conservation practices and a rather marked deficiency in rainfall during this period. The influence of soil conservation measures in this watershed seems small because very little of the land is terraced. Unless the next floods prove the contrary, it seems safe to assume that the deficiency in floods is mainly responsible for the low sand supply. However, the two influences mentioned could not have been significant factors in the unexpected reclamation of the

[1] Chief of division and hydraulic engineer, respectively, sedimentation division, Soil Conservation Service, Washington, D. C., and Greenville, S. C.

flood plains of George Creek because the rejuvenation of the stream was complete, or well along toward completion, before the decrease in the incoming sediment load became noticeable.

When we compare the watershed of George Creek with similar watersheds where the streams have not been rejuvenated, it seems evident that the two main influences responsible for the lowering of the stream bed and the resulting reclamation of the valley bottoms are (1) commercial sand pumping and (2) lowering of the bed of the river into which the stream flows. It must be emphasized here that the creek itself cleaned out its bed and that no dredging was done along the stream except at a few fixed points by the sand pumps. All this logically suggests the question of whether or not a method could be devised, utilizing these influences, singly or jointly, to achieve the same results in other localities without direct dredging and at permissible costs. Of course, such a method would have to operate in harmony with the laws of transportation of sediment by flowing water.

It is generally acknowledged that the rate of transportation of bed sediment in a natural stream is governed by the composition of the bed material and the flow of the stream. Inasmuch as the composition of the bed material remains substantially constant for a particular location, it may be neglected in discussing the variations in the rate of transportation. The reaction of the flow on a certain part of the bed can be defined by any one of several pairs of measurements. For convenience the measurements selected in this study are the discharge per unit of bed width and the surface slope of the water, although other factors, such as the depth of water and the average velocity for a unit of bed width, could be used. It is known from laboratory studies that the rate of transportation increases with increases in either the unit discharge or the slope. Heretofore it has not been possible to obtain quantitative measurements of this relationship in natural streams because of the lack of satisfactory methods of measuring the rates of bed-load transportation in such streams.

Within the last year a portable device has been constructed by the Sedimentation Division, Soil Conservation Service, for measuring the rate of bed-load transportation in small streams. Measurements made on Mountain Creek, a tributary of the Enoree River, S. C., have given some interesting results that soon will be published. For this discussion it is necessary only to know that the rate of transportation increases more rapidly than the unit discharge for a constant slope. This means that the amount of material transported per cubic foot of water increases with an increasing unit discharge. The same total amount of water passing at a particular time will therefore transport more bed load in a narrow section of the channel, where the unit discharge is greater, than in a wide section where the water is spread out and therefore the unit discharge is smaller.

These principles apply to the problem of George Creek. Before 1860, this stream was able to transport its sediment load without aggrading its bed. After that time a rapid increase in sediment load took place both in the Saluda River and George Creek. At some point on the creek which cannot now be determined, the load first exceeded the transporting capacity of the stream and sand was deposited on the bed, forming an obstruction and reducing the slope. The slope was progressively decreased upstream, thus decreasing the transporting capacity of the flow. More sediment was deposited upstream and, like a contagious disease, sedimentation spread throughout the length of the channel. This process of plugging probably started at different points in the channel at different times, but the depositions eventually merged into one another. With the higher bed, smaller floods went overbank, spreading out their waters, and thus again decreased the ability of the stream transport. So the bed was built up until the channel was able to contain only low-water flows, while the ground-water level rose in the flood plain and the land became swampy. Meanwhile much bed sediment was spread over the valley bottoms and a much smaller portion than formerly went down the stream. If this cycle had continued for centuries, the bottom lands probably would have been built up until the creek was able to carry its greater load within its banks at the new and increased slope.

The cycle of aggradation was interrupted, however, by the works of man, by pumping sand and the building of a dam. Unfortunately, there is no basis for evaluating separately the effects of these two factors in bringing about the changes in George Creek. The dam built on the Saluda River in 1905–06 seems to have been an efficient sediment regulator that caused most of the sediment to deposit in the reservoir and at no time passed more sediment than the stream below the dam was capable of transporting. Prior to 1905 the Saluda presumably was aggrading its bed and would have continued the process had not the building of the dam interfered. From 1905 to 1928 the bed of the

(*Continued on p. 22*)

R. C. Rayburn, who pepped up pinto production.

TERRACES QUADRUPLE PINTO BEAN YIELDS

By R. G. HOWARD[1]

"Terraces have doubled the value of my land and more than doubled my bean yields," is a statement often made by R. C. Rayburn, a farmer living about 30 miles east of Albuquerque, N. Mex.

His farm lies on both sides of U. S. Highway 66, where it is seen daily by hundreds of tourists and by most of the local farmers. Tourists whiz by—slower than they did before December 7, but nevertheless too rapidly to get more than a hasty glance at rolling fields and fence posts and occasional houses. But the farmers travel more slowly. They go by on horses and tractors, or drive their cars with an observing eye, because, next to war, farming is news in the little town of Edgewood, 2 miles west of Rayburn's farm.

[1] Unit conservationist, Southwest Region, Soil Conservation Service, Albuquerque, N. Mex.

In Edgewood, people gather at the post office or Denton's Cafe or Bassett's Bean House, and talk. They talk of war and of farming—of contour farming versus straight line farming, of terrace farming versus down hill farming, of strip cropping versus large fields of a single crop. Their arguments are backed by farming experience, and are won by yields when crops are harvested in the fall.

Like farmers everywhere, they have a pride in their work and believe their land the best in the world. It becomes a part of them and they hate to see it wash or blow. True pioneers and true Americans, all have different ideas of how to farm and how to control erosion and conserve moisture. Rainfall averages only 17 inches a year in this area, and all that can be held on the land where it falls means that much more toward the growing of a crop. The biggest factor against the farmers is time. To hear them tell it, planting is invariably a month late, they miss a couple of cultivations during the summer, and harvesting runs on into winter.

R. C. Rayburn is typical of this group. An elderly man, he moved to Edgewood in 1937. He had owned his farm there for several years but had previously rented it to a share cropper. The surface soil had blown and washed away until it was considered the most run-down farm in the Edgewood community. He followed the custom of the country by planting most of his acreage to pinto beans. He hoped to meet the average production of 300 pounds per acre, but autumn rolled around and he harvested only 200 pounds per acre.

The next year, 1938, was dry. The only rains were hard, dashing showers that ran quickly off the sloping land. Hard, dashing showers and side-hill fields do not make the ideal combination for bean production. Mr. Rayburn did not even bother to harvest his crop.

In the winter of 1938–39 Mr. Rayburn walked over his fields and studied the mounds of blow sand along the fences and the gullies that carried away both topsoil and subsoil. One gully was 2 feet deep. The field had been farmed in two pieces because he could not cross the gully. As he studied his problems he remembered that his father had farmed terraced fields in Louisiana 55 years ago and he recalled that his father had often said, "Son, terraces and contour farming distribute moisture over a wide area. They prevent concentration of water in one place and if too much falls, they turn it loose where it won't hurt anything." So Mr. Rayburn solicited the aid of the Soil Conservation Service and terraced his farm with the assistance of a CCC camp.

He received lots of advice from his neighbors about his "stunt." Some of them said he would

never be able to negotiate the curves. Others said his tractor would turn over the sides of the broad-base terraces. Several, skeptical of the Government and its "gift horse," argued that Rayburn would be "taxed to death and lose his farm." But Mr. Rayburn had studied his cooperative agreement with the Soil Conservation Service until he knew it almost word for word. He felt, so he said, that it was for the good of his land, and he "figured" the Government was really trying to help farmers.

In 1939 the rains again fell in hard, dashing storms, but this time the water stayed on the land. Most of it stayed where it fell because Mr. Rayburn farmed on the contour, and every row made a miniature dam. Where the water was too much for the contour rows to hold, it ran down against the terraces and leveled the gullies with silt, and when there was too much for the terraces, the water ran slowly around the ends on to the grass strips along the fence rows. That year the farm averaged 420 pounds of beans per acre.

In 1940 the yield was 686 pounds per acre.

That fall the first hard wind came earlier than usual and many farmers had not finished listing or chiseling their land to prevent blowing. As the wind gained in velocity, dry dust began to creep along the ground until finally the lighter particles swept upwards in huge clouds while the heavier pieces made dikes along the fence rows. On Mr. Rayburn's farm, dirt started to move, too. But the first terrace served as a windbreak and the wind dropped its load and actually improved the terrace by giving it greater height and width. Half way to the next terrace the dust particles again started to move, but again they were stopped by the terrace—and so on across his entire field.

That evening at Denton's Cafe in Edgewood several farmers were gathered who had passed by Rayburn's farm that day and had seen how the terraces kept the soil from moving. They had always supposed before that terraces and contouring were good only for retaining moisture. But now they realized that terraces were also an asset in the control of wind erosion. Terraces would not take the place of listing or chiseling or cover crops in controlling wind erosion—they knew that—but they would be a great help in holding the soil in place during the first three or four hard winds. Rayburn and a few others who had more recently constructed terraces were the center of a respectful group. They had made a "clean scoop" in the field of conservation.

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The last bits of snow still cling to the contour-listed furrows on this slice of the Rayburn farm. That means more beans. Alternate furrows are listed, and terraces—one of which is shown here—afford added assurance of satisfactory yields.

To speed conservation on a recently acquired 40 acres, Lincoln & Lincoln borrowed level and rod, ran the contours themselves. By this time they were old hands at soil saving, a conservation plan having been put into effect on 80 other of their acres. That's good looking grain sorghum, Jack!

SOUND PLANNING AND HARD WORK

By CHARLES G. WEBB[1]

If these two farm people represent a trend in Arkansas agriculture, it is a trend good for the State—and the Nation.

In a State where one-crop farming has predominated, Mr. and Mrs. Jack Lincoln, of Benton County, are practicing diversified farming. In a State where soil erosion has attacked 15,500,000 acres of land, the Lincolns are soil conservation farmers. In a Nation where too many young people leave the farm and where too few farm-born college graduates return to the farm, Mr. and Mrs. Lincoln are graduates of the University of Arkansas. They believe that there is opportunity for young people on farms in Arkansas.

"If we didn't believe that, we would not be here," Mrs. Lincoln remarked.

The Lincolns know that sound planning and hard work are required to make the most of the opportunity, and they practice what they know. They are converting an old eroded 80-acre farm, largely in dead or dying apple trees, into a paying, conservation-treated livestock farm. They are putting soil-conserving and soil-improving practices on 40 acres which they bought recently.

Evidence that the Lincolns have worked hard can be found everywhere on their farm. Their residence is being improved, and the barn, broiler houses, and other small buildings are in a good state of repair.

When they bought the 40 acres they applied to the supervisors of the Benton County Soil Conservation District for assistance in planning and carrying out a complete soil conservation program on this piece of land. Their farm was not in a priority work area established by the supervisors, and they were told that months might elapse before Soil Conservation Service technicians assigned to the district could reach them.

But at the University Jack Lincoln had learned how to operate a level. He borrowed a level and a rod from the county agent, P. R. Corley, and he and his wife, working together, laid off lines for contour

[1] Associate information specialist, Western Gulf Region, Soil Conservation Service, Fort Worth, Tex.

cultivation and contour strip crops on the 40 acres. Corn and sorghum were planted on the contour and, early in the fall of 1941, contour strip crops of alfalfa and red clover were planted. Another evidence of sound planning was the fact that lime and superphosphate were applied to the land and heavy growths of soybeans and Sudan grass were plowed under before alfalfa and red clover were planted.

"We always use all the AAA check to buy lime and phosphate to put on the land," Lincoln said. "And we grew and harvested the red clover seed we planted."

Lincoln began his intensive soil conservation program back in 1938 when he became a cooperator with the soil conservation demonstration project in his county. At that time he owned 80 acres in one block—more than 60 acres of it in old apple orchard—and 20 acres in another nearby tract. In 1940 he sold the 20 acres and bought 40 acres adjoining the "eighty."

One of his biggest jobs was clearing off the fruit trees and establishing conservation practices on the old orchard land. This job has been completed on 35.7 acres that now are fully protected from soil erosion and are producing feed and hay crops needed on the livestock farm.

Crushed limestone and superphosphate were spread on 7.5 acres of contour meadow strips of alfalfa and clover which Lincoln has developed, on 5 acres of timothy and red clover, and on 8 acres of timothy and red top meadows. Feed will be produced on the 15 acres of row crop area. The practice of alternating 75-foot contour meadow strips with 120-foot intervals of cultivated crops has been combined with contour tillage and an approved crop rotation to control erosion and to improve the soil.

"There is no question that this program has controlled the washing and has improved the land," Lincoln declared.

Conservation farming methods have helped prepare this farm for increased war-time food production. This farmer and his wife plan to increase milk and egg production 50 percent during this year; pork production 400 percent; oats 25 percent; hay 15 percent; soybeans 30 percent; and the home garden 50 percent. Last fall they were milking 4 cows, and they had 15 heifers, 4 of which were to bring calves early in 1942 and 4 others in the autumn. Whole milk, testing about 4.8-percent butterfat, is sold to the cheese factory at Bentonville, Ark. In this way, erosion-resisting crops are being converted to a food vitally needed by the United States and her Allies.

The hay crops cut in 1941 included 20 wagon loads of red top and timothy, and 20 loads of red clover. Barley, winter oats, corn, and grain sorghums are among the other crops grown. Approximately 16 acres of formerly cultivated land have been developed as pasture. Bermuda grass, bluegrass, perennial ryegrass and lespedeza are in the pasture.

Broiler production adds to the farm income—there are broiler houses sufficient to grow 6,000 chickens at one time, and within 12 to 14 weeks the broilers average 3 pounds. As a means of producing more food at home, the Lincolns are establishing a 1.5-acre orchard and vineyard. Trees and vines will be placed on the contour and other soil-conserving, soil-improving practices will be used.

STREAMLINING CUTS UPKEEP

(Continued from p. 9)

yard in 1941, whereas in some nearby States the average was 40 cents. The seeding method of establishing protective vegetation along the State's highways has enjoyed the same widespread expansion.

Costs of maintaining the right-of-way on the demonstration strip have been reduced $125 per mile per year. Comparative snow removal costs are not available, but studies made on similar work in Minnesota show that the saving has been as much as $800 per mile a year.

Finally, here is the studied evaluation of the work made by Harold E. Olson, Minnesota State Highway Department roadside engineer:

"We feel that the Zumbrota-Pine Island demonstration was very much worth while. In value based on fair unit prices, the State received a dollar's worth of actual value for each 59 cents expended.

"In addition, the construction of the streamlined cross-section and the obliteration of the old construction scars have transformed this area, which formerly required a great deal of maintenance, into an attractive development, the cost of which was well warranted because of the maintenance savings."

WIRKLER AND HIS VICTORY FARM

(Continued from p. 11)

that crazy new way." That farmer, however, saw the benefits his neighbors gained and today has every field on his place contour strip-cropped.

In addition to his many other activities, Butch Wirkler sells some hybrid seed corn to his neighbors and friends. "Every now and then I forget what I'm doing at the moment and give them a sales talk on soil conservin'."

Butch is deeply concerned about the prospect that war production may deplete further the soils on many farms. That is why he says with feeling: "We have just got to take care of our land. Why, eventually most all the cost of this war has got to come out of the soil. We just can't allow it to be wasted."

PLOW METHOD OF TERRACE CONSTRUCTION

By PAUL M. PITTENGER [1]

Advantages of Constructing Terraces With a Plow

1. All farmers have the necessary equipment, and it is always available when conditions are right for terracing.
2. Labor and equipment costs are low.
3. Farmers understand the operation of a plow.
4. Terrace cross-sections are uniform, and areas of exposed subsoil cause little variation in terrace height.
5. Equipment slips very little on curves.
6. Wide channels and ridges, which are so important in terrace construction, are easily obtained with a plow on 1- to 6-percent slopes.
7. Moving of terracing equipment from farm to farm is eliminated.

EXPERIENCES of farmers and Service personnel in the Montgomery County Soil Conservation District (Illinois) show that the ordinary plow—tractor, horse-drawn, riding, or walking—can be used successfully in the construction of terraces. The use of this equipment, some of which is found on every farm, will simplify the job of getting terraces established on the land.

Most terracing equipment is rather expensive and has very little use except for the one purpose, which means that only a few individual farmers ever will own such machines. This fact has made it desirable that we develop a method of terrace construction to utilize ordinary farm equipment.

Terraces are being built in the Montgomery County district with the ordinary farm tractor and two-bottom plow as rapidly or more rapidly than with a small 6- or 8-foot blade grader. One man handles the equipment and very little supervision is needed because all farmers know how to use a plow—they need only a staked terrace line and a demonstration of the system of construction. Twelve miles of terraces were constructed in the district by this method during 1941, while only one-fourth mile was constructed with a blade.

[1] Assistant soil conservationist, Montgomery County Soil Conservation District, Hillsboro, Ill.

Terraces on 1- to 6-percent slopes, to be constructed from both sides, are started by turning furrows downhill. The stakes represent the center line of the terrace channel, and the first furrow should run 3 to 5 feet below the stakes. With some equipment it is necessary to start plowing about 5 feet below the stakes to avoid knocking them down on the first through.

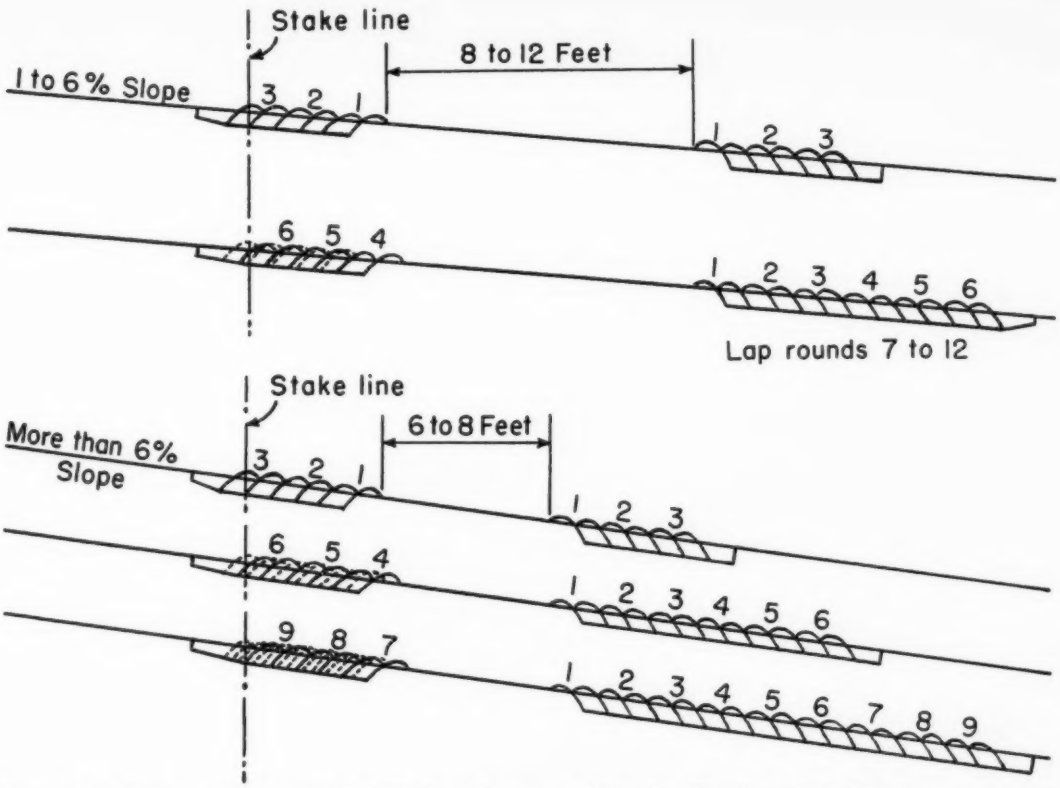
The stakes are then reset about 12 feet down the slope to guide the return trip on the downhill side. This return trip leaves an "island" 10 to 12 feet wide. From this point, the construction follows a rather definite system of overlapping each three trips on the upper side of the "island" and each six trips on the lower side. By following this system, a "wave" of soil 6 furrows wide will be pushed over the "island" from the upper side, and a wave of soil 12 furrows wide will be pushed over it from the lower side. Usually the terrace is complete when this "island" is plowed out, or covered, and the waves are well lapped together.

The plowing must be deep in order to give the terrace sufficient height. This can be done by keeping the tractor or team well up on the loose soil. Twenty-four rounds usually will complete a terrace. One additional round is then made—one trip at the upper base of the ridge and one trip at the lower base of the ridge, with the rear plow set shallow—to help develop a more uniform cross section at these points.

The terrace channel is established when the island is covered, so it is important to have it of sufficient width to form the desired channel. A 12-foot island will form an 8- to 10-foot channel. When plows of sizes are used, the number of trips is varied to form a wave of soil of approximately the same width as that formed by a two-bottom 14-inch plow. A two-bottom 12-inch plow works best in series of four trips on the upper side and eight trips on the lower side.

When the above procedure is followed the terrace should have approximately the following dimensions: Bottom width of channel, 8 feet; settled height of ridge, 1.1 feet; width of ridge, 24 feet; and total disturbed area, 38 feet. Additional height can easily be attained by back-furrowing.

Terraces on slopes steeper than 6 percent usually should be constructed entirely from the upper side.



Terraces on slopes over 6 percent are built from the upper side only. The "wave" is three furrows wide to cover an "island" 6 to 8 feet wide. Return trips just plow below the terrace.

Starting the terrace on these steeper slopes is the same as for less steep slopes, except that the island should be only 6 to 8 feet wide. Operations in completing the terrace will be similar to those followed in constructing the terrace from both sides, with the exception that the field is plowed below the terrace on return trips and a wave of soil is not brought from the lower side to cover the island. Usually, two-thirds or more of a terrace interval is plowed below the terrace by the time the terrace is completed.

Ed Battles, a key cooperator in the Montgomery County district, constructed 1,500 feet of terraces from the upper side with five horses and a two-bottom 12-inch plow in the spring of 1941. He said: "I had my field almost plowed when the terracing was finished and it worked mighty slick."

The district recommends that all terraces be made with a plow. Farmers have been constructing them at the rate of 150 to 250 feet per hour with two-plow tractors, and as much as 400 feet per hour with three-plow tractors. A few terraces have been constructed with walking and riding horse-drawn plows.

Land free of vegetation and with a considerable amount of moisture always works best in terracing with a plow. Where considerable vegetation is present, it usually is desirable to mow and rake the areas to be plowed; however, high-clearance plows can operate where there is considerable trash, provided the jointers, and sometimes the rolling coulters, are removed. Vegetation will cause the most difficulty the second time it is turned. To lessen the difficulty, the first plowing should be shallow, and the following trips should plow twice as deep as the first, especially on the upper side of the ridge and in the channel.

Terraces may be constructed from both sides or from the upper side only. On slopes steeper than 6 percent, they generally should be built from the upper side only. Slopes of 1 to 6 percent may also be terraced from the upper side, but construction from both sides usually gives the most desirable cross-section on these slopes.

THE SULLIVAN SAHARA

By W. S. UFER, E. A. TAYLOR, AND W. H. HILDEBRAND[1]

THE village of Sullivan lies within the South Muskegon Soil Conservation District about nine miles from Muskegon, Michigan. It consists of eight scattered residences, a general store, a cement-block town hall, a church, a rural school, and a cemetery.

The stranger in the town is depressed by the desolate helter-skelter appearance of the community. Buildings are badly in need of repair—they seem to have been built without purpose. Some are located along what might be a street; others are scattered on the landscape without rhyme or reason. The church, instead of being in the central part of the town, stands some 300 feet southward from the nearest resident. The entrance of the school faces the back yards of the houses.

Should the visitor be interested in learning the cause of the disintegration of Sullivan he need not search for facts in the archives of some distant institution of learning. He will find the unmistakable cause very near the edge of town. It is blowsand—1,200 acres of exposed sand subject to the whims of winds. When in motion, the sand particles find their way into the eyes, ears, nose and mouth of the inhabitant—or the visitor.

During windstorms of high velocities the sand grains are blown considerably beyond the boundaries of "Sullivan Sahara," and within the confines of the "Sahara" even dwellings do not afford the desired shelter from the sand. On windy days tiny sand particles penetrate into the homes through large or minute crevices to be deposited in fine layers on the objects within the rooms.

The school and the church, the collectively established institutions, are menaced by blowsand; it seems they must suffer for the sins committed collectively on the land by their builders, the careless exploiters of the past. Even the dead cannot escape the consequences of their mistakes—the sand masses are gradually creeping toward the graveyard as if to remind the present generation that abused nature will avenge itself eventually on living and dead alike.

Only 50 years ago Sullivan was a busy small town consisting of about 100 residences and 300 to 400 inhabitants. Oldtimers say that most of the residents worked in the 14 sawmills and 12 charcoal kilns, or hauled timber with their oxen, mules, and horses from the "inexhaustible" forests to the mills. Others transported the lumber from the sawmills and stacked it in rows along the railroad, rows extending as far as the eye could see. Still others earned their livelihood by working in the large railroad warehouse, the hotel, the drug store, the three stores, and several blacksmith shops. Amusement for the local people and visiting lumberjacks was provided in 19 barrooms.

In the Sullivan area, as well as in the neighboring country, lumberjacks of 50 years ago were busy cutting down the magnificent mixed hardwood-coniferous stands. They had the rare "privilege" of felling some of the world's finest white pine. When their logging operations were finished in a locality, the timber was sorted, first-grade for lumber, the next best for charcoal or other products. The remainder of timber and forest was destroyed by repeated fires.

The timber cutting in Sullivan Township was part of the irrational exploitation carried on in Muskegon County between 1838, when the first sawmill started humming, and 1916, when the inventory of "inexhaustible" forests showed no more logs to be floated down the Muskegon River. During the heyday of lumbering, in 1887, the annual output of lumber industries in Muskegon consisted of about 700 million board feet of lumber and over 520 million shingles. Within the 78 years of exploitation, 25 billion board feet of lumber were floated down the Muskegon River, or enough to have built a million six-room houses for the shelter of 5 million persons.

Muskegon lumber was shipped on Lake Michigan to Chicago. Fleets of lumber-laden ships, like endless flocks of seagulls, the oldtimers say, could be seen every day carrying lumber to Chicago. Many homes of the Middle West were built from Muskegon lumber; thus Sullivan contributed partly to the development of Chicago and the vast surrounding area. These contributions, however, were destined to ruin the village and township of Sullivan.

After the timber was removed from the land, farming and fruit growing promised an apparently prosperous future to the settlers. The light sandy soil could be worked with ease. A humus-charged layer of topsoil, formed through centuries of soil building under forest conditions, contained a large reserve of nutrients available for cultivated crops. The ease with which

[1]District conservationist and assistant conservationists, respectively, Soil Conservation Service, Muskegon, Mich.

this land could be worked, coupled with its ready and generous response, proved to be its undoing, and its fertility was soon exhausted.

According to the *Muskegon Times*, issue of September 4, 1911, there was a 40-acre, 5-year-old peach orchard 1 mile south and ½ mile west of Sullivan. The orchard was not cultivated, pruned or sprayed. Although many trees died from lack of care, the owner harvested about 1,000 bushels of peaches from his trees. Had the orchard received the needed care, the writer of the newspaper article believed, the yield would have been doubled. In any event, it was yields of this kind that stimulated the establishment of orchards in Sullivan Township.

General farming and fruit growing proved the wrong land uses for the extremely sandy soils of Sullivan Township. Because of its inherent qualities, and the neglectful cultivation, the soil became the prey of wind erosion. By 1925 the land of "Sullivan Sahara" was depleted and abandoned. Today the site of the peach orchard with 1,160 acres of neighboring land is transformed into an area of barren, shifting sand.

For a number of years migration was the settlers' only defense against the encroaching sands. The village shrunk gradually in size and population. Farmers and fruit growers abandoned their lands and homes. Today only dim traces of their former homesites can be found scattered throughout this area of desolation.

The present generation of Sullivan Township inhabitants, more alive to the meaning of proper use of the soil, are doing their best to correct the mistakes of the past, and prevent recurrence of land abuse in the future. These people have started the slow restoration of the "Sullivan Sahara," with the aim of leaving for generations to come a heritage consisting not of blowsand but of resources comparable to those which furnished the means for the establishment of the community more than half a century ago.

The first impetus to proper land use and soil conservation was given by Carl Knopf, the county agricultural agent who in 1925 arranged with 61 landowners for the planting of 150,000 pines on hitherto useless land. Nor was Mr. Knopf content with this achievement; he continued to foster land rehabilitation in Muskegon County and, due to his efforts, 2,000 acres of "worthless" land were reforested with 1,775,000 trees between 1925 and 1938.

The plantations demonstrated the feasibility of reforestation and conservation of those lands that were an actual or potential liability to the owners. In 1938, when establishment of a soil conservation district was made possible by State law, Mr. Knopf gave his full support to the organization of what is today the South Muskegon Soil Conservation District.

The owners of land subject to wind erosion realized the need of an organized effort to reclaim blow land and to prevent the potential blowing of soil. At the referendum of December 6, 1938, pertaining to the eight townships of the South Muskegon district, most of the favorable votes came from inhabitants menaced by wind erosion. Sullivan Township, having the largest blowsand problem of all, accounted for one-third of the total number of favorable votes.

Soil conservation activities in the area are fostered by many agencies and are being solved by various means. The district, in cooperation with the Soil Conservation Service, is assisting the landowners in solving their individual problems. In addition, the district coordinates the assistance furnished by other agencies. The Extension Service continues to work for the benefit of the district through its educational program. The County Board of Supervisors has made annual appropriations to support the district nursery. The CCC is furnishing labor to stabilize the more extensive blow areas. The National Youth Administration, the Farm Security Administration, and local people have furnished some of the labor needed for operating the district nursery, and for planting trees on land owned by local political subdivisions.

Ownership of land by local public agencies was secured through provisions of the Michigan Tax Reversion Act by which these political subdivisions may acquire title to tax-delinquent land not sold at the mandatory public auction. The soil conservation district encouraged public ownership of this type, chiefly in order to assure the permanency of the expensive and badly needed soil conservation measures, which, as indicated by the absence of bids at public auction, are beyond private means and interest. At present the political subdivisions in Muskegon County own 8,000 acres of land—3,445 acres belong to the schools, 4,300 acres to the townships, and 255 acres to the county.

Since the proper use for these public lands is forestry, ways and means have been developed to reforest them. The Soil Conservation Service prepares the planting plans and provides the technical assistance required to assure their satisfactory completion. The planting stock is provided partly free of charge and partly by purchase. The State Conservation Department furnishes five thousand 2-0 pine seedlings each year to

each land-owning political subdivision. The district lines out the 2–0 Conservation Department stock and returns it to the respective organization as 2–1 transplant material. Within the prescribed limitations the Soil Conservation Service furnishes 2–1 transplant stock. The local public agencies buy, at cost, the remainder of their trees from the district-operated nursery.

Trees are planted by school children, adults, or both, depending on the ownership of land. Each spring and each fall the county agricultural agent and the Soil Conservation staff members organize planting bees on school and township lands. Muskegon County boys and girls and their parents have planted 400,800 trees on school properties since the spring of 1940. Approximately 1,100 school children and parents take part in 40 planting bees each year. At present the schools and townships of Muskegon County can boast of an inventory showing 575,000 trees planted on their holdings.

The conservation work of the district is not limited to physical accomplishment only: The chairman of the soil conservation district's Board of Directors and the County School Commissioner have made provisions whereby the schools of Muskegon County will initiate standardized courses dealing with soil conservation in a broad sense. It is planned that classes be conducted to include the theoretical as well as practical side of conservation, and that these courses be supplemented by field trips to show the young generation the pitfalls of irrational land use and ways and means of preventing their recurrence in future years.

It is true that trees are long in growing to maturity. But, 50 years from now, perhaps the visitor will see a new Sullivan located in the midst of vigorous, green forests, instead of the drab "Sullivan Sahara." Perhaps the town will have new houses, and new streets arranged in an orderly fashion. Even if the resurrection of Sullivan should not materialize, it is reasonable to assume that if the present efforts of the soil conservation district continue long enough the visitor will be tempted to linger for a while in the forests of Sullivan Township, instead of fleeing the "Sahara" that is Sullivan Township today.

REJUVENATION OF GEORGE CREEK

(Continued from p. 13)

Saluda for some distance below the dam remained substantially unchanged, and then the great flood of 1928 cleared out the channel, materially lowering the elevation of the bed. It is said that at this time George Creek began to clean out its channel and the process was continued until a bed level was reached that probably is lower than it was in 1860.

The first sand pump was installed 3 years before the big flood on the Saluda, and other pumps were installed later. Undoubtedly a considerable amount of sand was removed from the creek bed at one or more points during these 3 years, and it is easily possible that the rejuvenating process had started before the 1928 flood but had not progressed far enough to be noticeable to the local observers. There is also the possibility that the effect of the sand pumps could have caused this rejuvenation without the aid of the Saluda flood. The history of George Creek definitely proves that the rejuvenation of a stream is possible after its excessive sediment burden is removed, but it does not answer the important question of whether the lack of sediment alone will start the cutting or whether some direct assistance must be given to induce the process.

The Sedimentation Division of the Soil Conservation Service is now studying this problem. The method of attack is to select a small stream of the character of Beaverdam Creek and actually measure its transporting capacity. Then, at carefully chosen points, the bed-sediment load is artificially decreased and a study is made of all the effects of these deficiencies. While no predictions are yet possible as to whether the stream can be made to clean out its channel, the results of the studies should shed some light on several problems that are now of much concern in soil conservation and flood-control programs.

TERRACES QUADRUPLE BEAN YIELD

(Continued from p. 15)

In 1941 Rayburn harvested 879 pounds of beans per acre after a 10- to 20-percent damage by hail. Luckily, the hail damage was covered by insurance so that he received the benefits of his potential yield of 1,000 pounds per acre. R. C. Rayburn is very proud of his terraces and of his method of farming and of his yields.

"Good land is getting scarce," he said recently. "Farmers in this part of the country have got to use terraces and contour cultivation, because they can't move over to new land when the soil on their old farm washes or blows away."

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Field offices should submit requests on Form SCS–37, in accordance with instruction on the reverse side of the form. Others should address the office of issue.

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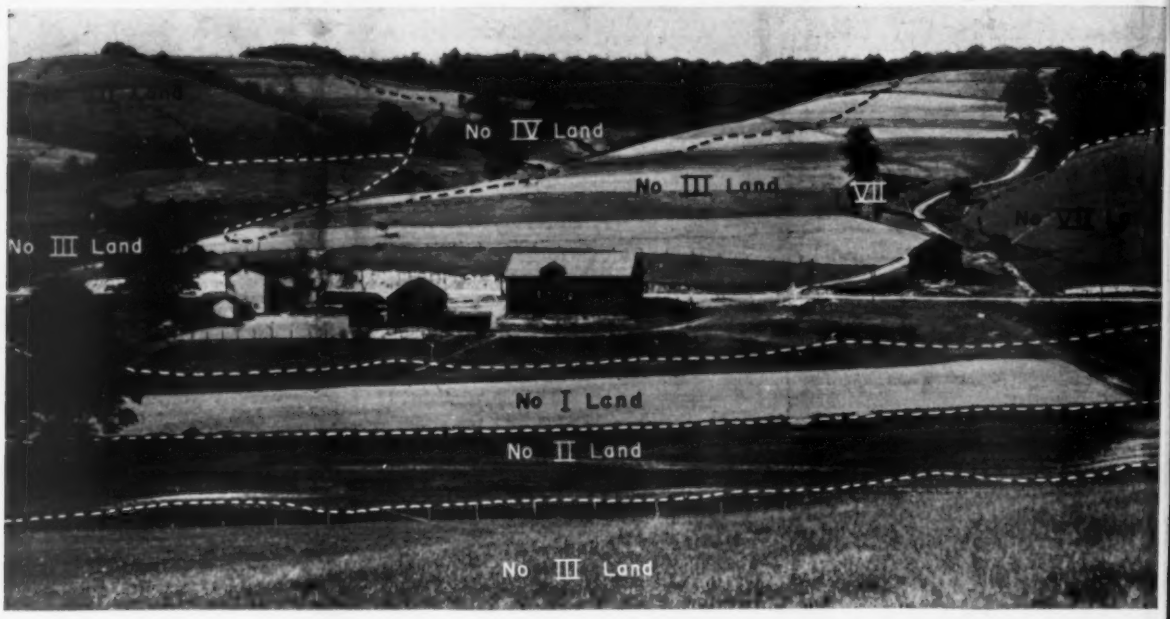
[1] Prepared solely for use by the Soil Conservation Service and official cooperators. Not available for general distribution.

[2] From Superintendent of Documents, U. S. Government Printing Office Washington, D. C.

SELECTIVE SERVICE FOR EVERY ACRE



This is a war of production—
Production of planes, ships, tanks, shells—
And food and fiber.

Crop and livestock yields are increased
Through soil and moisture conservation.

Every acre of agricultural land can be made to produce
The things needed to win this war—but—
You would not expect to produce planes in a shell factory,
Nor tanks in a shipyard—
Neither should you expect to produce
Peanuts, cotton, corn, and other row crops
On steep land—or on eroded land
That is best suited to trees or grass.
The row crops will permit severe soil erosion
And after a few seasons
The land may be out of production
For many years to come.
Take a look at the back of this sheet.

Pick out the different classes of land on your farm,
And study the recommended use
And conservation practices
That will keep every acre in production—
The war may be a long one.

To Region IV, Soil Conservation Service, we are indebted for this simple guide to land classifications according to capabilities.

Picture and text were inexpensively processed recently on low-grade paper, and distributed in the Southwest. On the back of each sheet were practical recommendations suited to local farm conditions.

This is another of the numerous devices for getting the war-production job done with a minimum of delay—soil conservation now being accepted as an important way to increase yields.